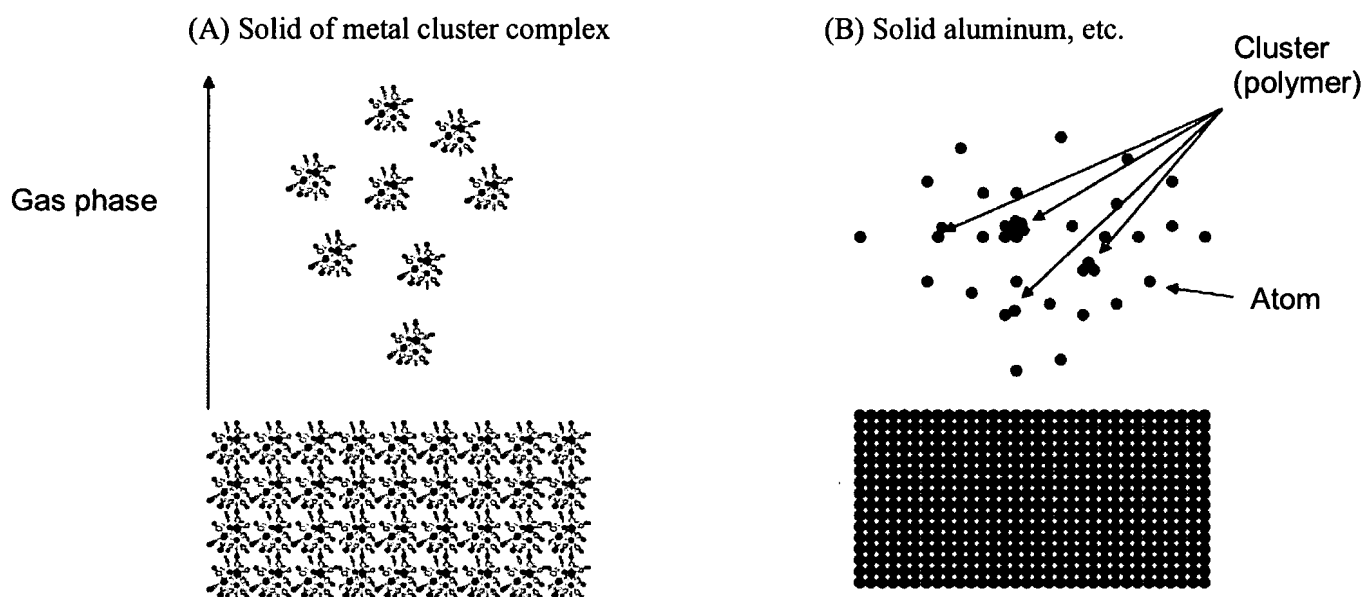




Difference in gasification between a metal cluster complex solid vs. solid metal



(A) In the case of solid of metal cluster complex

When a solid of a metal cluster complex (a multi-nuclear metal molecule) is utilized as a source for generating a molecular beam, i.e. a cluster ion beam, the metal cluster complex is released from the solid into a gas phase, while the unit structure of such a complex molecule is maintained. This is because the metal cluster complex molecule is chemically stable. That is, as a result of this phenomenon, the resulting cluster complex size in the gas phase has no distribution. Further, since the metal cluster complex itself is stable, there is such an advantage that it is hardly suffered influence of external disturbance.

Generally, a cluster beam is intended to utilize a function as a plurality of clusters of atoms. This function is predominantly governed by cluster complex size in a molecular beam to be emitted. Thus, if the cluster complex size has a distribution, it brings hindrance on utilization of the cluster beam. Further, the distribution of cluster complex size is based on the difference of mass number of clusters contained. So, it is made difficult to converge the beam which has such a distribution of cluster complex size, so that the utilization of the cluster beam is hindered.

As explained above, one feature of the present invention resides in that a chemically stable metal cluster complex, which is solid, is to be used as a source to generate the cluster. As this originality is accepted, the present inventors have attended at invitational lectures in international societies.

(B) In the case of solid aluminum, etc.

When energy is given, for example, to metal solid such as aluminum by heating or in another manner, atoms in part constituting the metal cannot stay in the solid state and are released into a gas phase. As a form of that releasing, there can be mentioned a cluster (or polymer) associated with a plurality of the atoms, as well as an atom per se. An atom/cluster ratio and/or a cluster size distribution may vary, by changing the kind or composition of atom(s) constituting the metal or the method of applying energy. Further, there are some attempts intended for controlling cluster size by controlling the pressure of a gas phase or the kind of co-existent gas. However, cluster size distribution has generally a wide distribution, e.g. 100 to 1,000 atoms/cluster-molecule.

Further, it is also possible to form clusters, using collision and association of atoms or cluster in a gas phase, with adiabatic expansion or the like. However, in that case, the sizes of the resultant clusters have a wide distribution. Even if ionic reaction at a gas phase is used, it is difficult to form a single species of cluster uniform in the size thereof.

Furthermore, in these methods, formation of cluster is governed by probability and tends to be affected by influence of outer disturbance, and it is difficult to form the cluster stably.